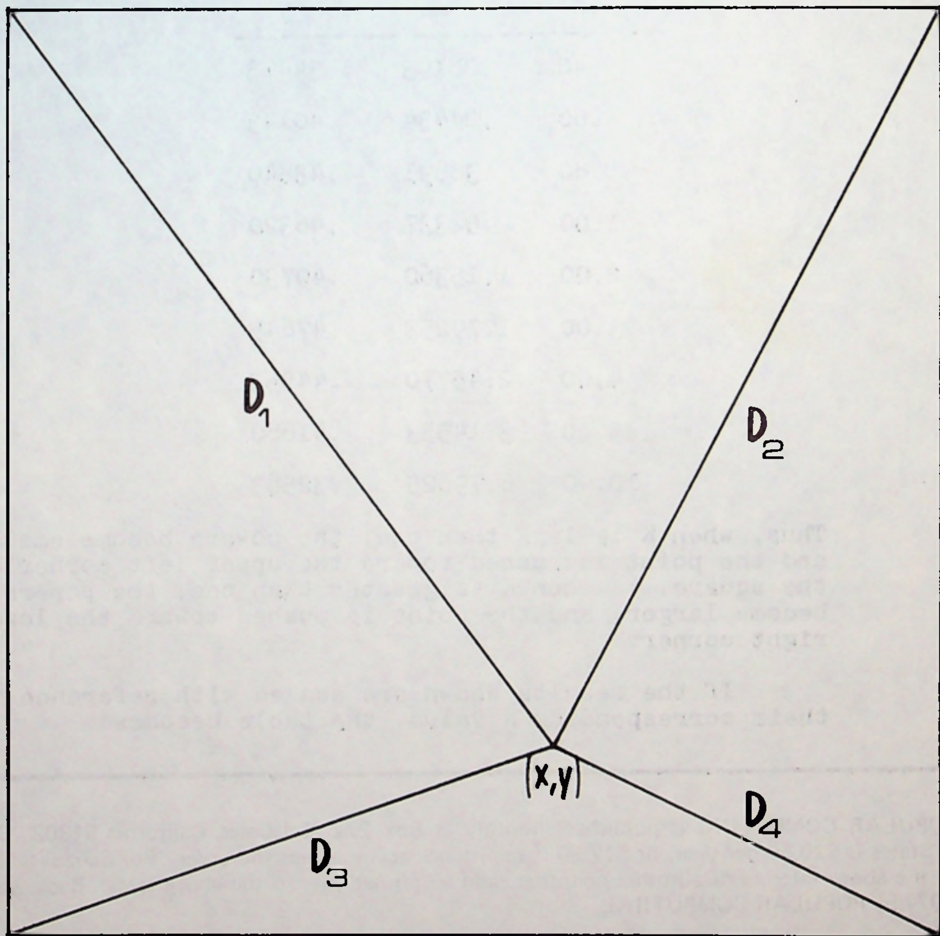
56

November 1977 Volume 5 Number 11

Popular Computing



A Problem of Scale

A Problem of Scale

In the Figure on the cover, point (x,y) is to be located in the square of side K so that

$$D_1 + D_2^2 + D_3^3 + D_4^4 = F$$

is a minimum. For any given value of K, the point (x,y) is uniquely located. We have these approximate results:

K	x	y
.40	.08193	.34473
.60	.24434	.40143
.80	.38891	.43840
1.00	.52337	.46320
2.00	1.15360	.49790
3.00	1.79253	.47645
4.00	2.45770	.44553
5.00	3.14553	.41680
10.00	6.79625	.32583

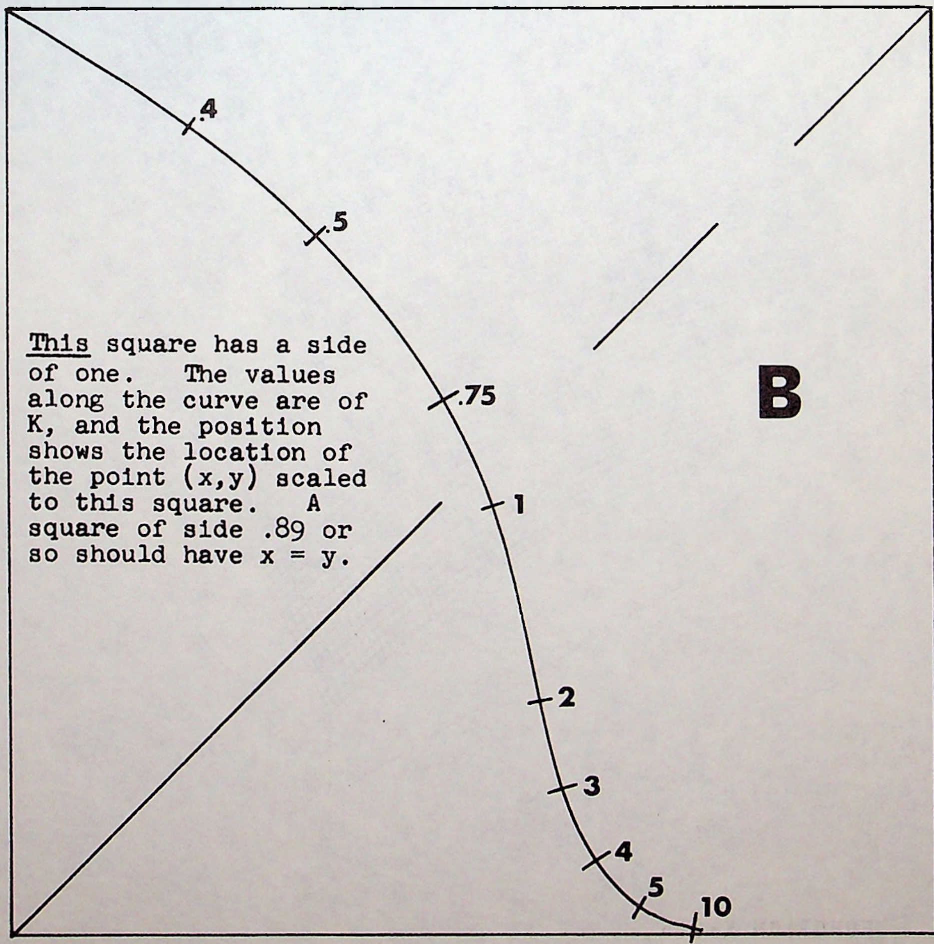
Thus, when K is less than one, the powers become smaller, and the point is pushed toward the upper left corner of the square. When K is greater than one, the powers become larger, and the point is pushed toward the lower right corner.

If the results shown are scaled with reference to their corresponding K value, the table becomes:

POPULAR COMPUTING is published monthly at Box 272, Calabasas, California 91302. Subscription rate in the United States is $20.50 per year, or $17.50 if remittance accompanies the order. For Canada and Mexico, add $1.50 per year to the above rates. For all other countries, add $3.50 per year to the above rates. Back issues $2.50 each.

K	x	y
.40	.20483	.86183
.60	.40723	.66905
.80	.48614	.54800
1.00	.52337	.46320
2.00	.57680	.24895
3.00	.59751	.15882
4.00	.61443	.11138
5.00	.62911	.08336
10.00	.67963	.03258

Figure B below shows the resulting trend.

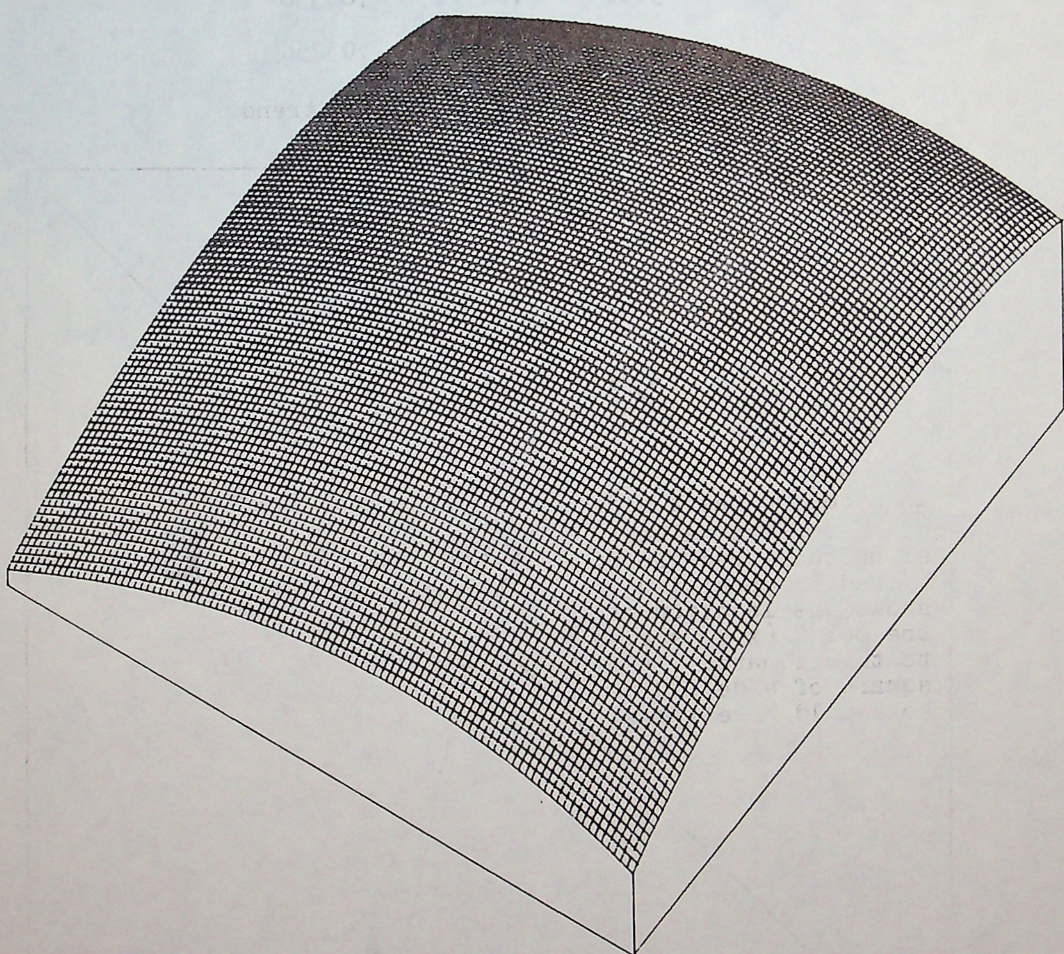


There are three problems here:

1. For a given value of K, is there an analytic way to determine the point (x,y)?

2. What is a practical search method to find the point (x,y) for a given value of K? That is, what process corresponds here to bracketing, or interval-halving?

3. It is clear from Figure B that, for some value of K, x = y. How can that value of K be found?



FUNCTION K=0.5

The function whose minimum we are seeking is quite well behaved. For any particular value of K, say K = .5, we can calculate the value of the function for 10,000 points (that is, 100 equally-spaced values on x and y) as shown in the accompanying plot, made by Associate Editor David Babcock. (The function has been inverted, so that we are looking at the under side, where the true minimum now sticks up as the highest point.) Thus, any systematic search procedure should not run into problems of local minima, saddle points, and such.

Mr. Babcock used a bracketing process to locate x and y to 8 significant digits for a given value of K. From the following table:

K	x	y	function
.81	.39582310	.43988511	1.19090567
.82	.40271230	.44134320	1.21965054
.83	.40957831	.44277290	1.24875990
.84	.41642190	.44417459	1.27823601
.85	.42324380	.44554880	1.30808116
.86	.43004460	.44689610	1.33829760
.87	.43682490	.44821710	1.36888758
.88	.44358538	.44951220	1.39985336
.89	.45032661	.45078190	1.43119716
.90	.45704920	.45202660	1.46292124
.91	.46375380	.45324690	1.49502781
.92	.47044080	.45444310	1.52751910
.93	.47711080	.45561570	1.56039733

it appears that around K = .89, x and y will be equal. That is our problem 211: to find that value of K to greater accuracy.

This PROBLEM OF SCALE is one of the most challenging problems we have presented. Various schemes for locating (x,y) for a fixed value of K by mathematical approaches have not proved feasible, and no scheme (other than cut-and-try) suggests itself for finding the K for which x = y. We solicit further investigation by readers.

PROBLEM 211

Problem 187 (issue 54) called for polynomial equations with integral coefficients having a root close to pi. Herman P. Robinson calls attention to these:

$19x^2 - 39x - 65 = 0$	3.1415882...
$99532x = 312689$	3.14159285...
$x^4 = 81 + 361/22$	3.1415926526...

☆ ☆ ☆ ☆ ☆

In issue 53, page 11, a list of corrections for the logarithm table of issue 51, page 15, was given.
Unfortunately, <u>that</u> list contained an error, too. The correct value for the logarithm of 59 (the 41st through 50th decimals) is:

46789 33<u>0</u>45

☆ ☆ ☆ ☆ ☆

Problem 189 (issue 54) called for the formation of a transcendental number, GG, in which the Kth decimal place of GG is the Kth decimal in the square root of K.

Herman P. Robinson calculates GG to be:

.01206 93201 57946 04621 86380 04248 59904 00321 24398 90104

34357 08437 75706 26057 00364 30259 03888 40185 47396 07020...

★ ★

Hamming's Law of Statistics

90% OF THE TIME THE NEXT *INDEPENDENT* MEASUREMENT OF SOMETHING WILL FALL OUTSIDE THE REPORTED 90% CONFIDENCE LIMITS

So you think you understand how random processes will behave?

Exploring Random Behavior -- 3

We have been exploring the contention that people acquire a feeling of confidence concerning the nature and behavior of random numbers but do not really understand how they behave. This month we present a little self-test.

As usual, we assume the availability of a random number generator whose output is a long stream of numbers, X_1, uniformly distributed in the range from zero to one, but not including those values; that is,

$$0 < X_1 < 1.$$

Any large collection of such numbers should have a mean of .5 and a standard deviation of .288675.

What sort of distribution is found by taking various combinations of such numbers? In the ten combinations at the right, each X represents a separate random fraction. The game here is to guess the mean and standard deviation of a set of numbers formed as indicated.

For example, in case 1 we have $\frac{X + X}{2}$.

This means that two random numbers are drawn, and the average of the two is taken. Call one such average value R. For a set of many values of R, what will be the mean and standard deviation?

Estimates are given on the next page, but the reader is urged to make his own estimate first.

1 $\frac{X + X}{2}$

2 $\frac{X + X + X}{3}$

3 $\frac{X + X + X + X}{4}$

4 $\frac{X + X}{X + X}$

5 $\sqrt{X^2 + X^2}$

6 $(\sqrt{X} + \sqrt{X})^2$

7 $\sin^2 X + \cos^2 X$

8 $\sqrt[X]{X^X}$

9 $((XX + X)X + X)X$

10 $\frac{X}{X}$

From limited empirical runs, we have the following results:

Type	Mean	Standard Deviation
1	.4862	.2050
2	.5100	.1698
3	.4938	.1443
4	1.6414	2.3890
5	.7832	.2845
6	1.8458	.8409
7	1.0019	.3176
8	.5053	.3336
9	.4281	.3315

Type 10 (X/X) is the hard one. Even if a given X cannot be zero, a combination like

$$\frac{.789543}{.001234} = 639.8$$

must be expected occasionally, whereas the "normal" ratio will average 3.5 or so. Successive runs in which any ratio that exceeded 300 was excluded from the calculation showed these results:

Sum	Sum of squares
304.3273	8209.3174
399.4070	25942.6084
204.1000	1440.3781
177.3279	1397.6504
401.3282	25214.3494
357.7851	9623.0206
510.4328	57492.0393
176.8460	1041.0032
355.6219	15151.2083
668.5856	169011.2860

(each of these runs was of 100 trials.)

Problem Solution

N	X	D
1	1	1
2	2	2
3	4	3
4	7	3
5	10	4
6	14	4
7	18	4
8	22	5
9	27	5
10	32	5
11	37	5

Problem 191 (issue 54) was titled "A Coding Exercise," and was intended to be just that. The function, X, is to advance by D, with D being successive integers, each repeated the number of times (1, 1, 2, 3, 5, 8, 13,...) given by the Fibonacci sequence. Problem 191 asked for the 1000th term of the X sequence, and a formula for the Nth term.

A flowchart is shown for a direct attack on the problem.

David E. Ferguson has produced a formula for the Nth term. For X_N, determine n from the Fibonacci sequence such that

$$u_n \leq N < u_{n+1}$$

Then $X_N = (n - 1)N - u_{n+2} + 3$.

Thus, for X_{1000}, we first determine the position of the number 1000 in the Fibonacci sequence (shown at the right) as between terms 16 and 17, giving n = 16. Then

$$X_{1000} = (15)(1000) - 2584 + 3 = 12419.$$

Direct calculation, using the logic of the accompanying flowchart, is in agreement.

Ferguson's formula lets us calculate any term of the required sequence with minimum effort. For the 100,000th term, for example, it is easy to find that the number 100,000 lies between the 30th and 31st term of the Fibonacci sequence, so that n = 30. Then

$$X_{100000} = (29)(100000) - 2178309 + 3$$

$$= 721694$$

1	1
2	1
3	2
4	3
5	5
6	8
7	13
8	21
9	34
10	55
11	89
12	144
13	233
14	377
15	610
16	987
17	1597
18	2584
19	4181
20	6765
21	10946
22	17711
23	28657
24	46368
25	75025

Introducing th
respected vi

Quite simply, Games & Puzzles Magazine is unique. There is no other publication quite like it anywhere in the world.

Started four years ago by a small team of games experts, games inventors and journalists who were games devotees, Games & Puzzles has since grown substantially to become recognised throughout the world as the leading authority on games, games inventions and games playing.

The magazine is witty, entertaining, and most of all objective and highly informed: its subscription list reads like a who's who of the games world.

So if you're interested in playing, inventing or even making games, it's the one publication in the world you really can't afford to miss.

What Games & Puzzles has to offer

Games & Puzzles examines the world of games every month with three points in mind: to provide a totally independent, objective viewpoint; to be authoritative; and to provide its readers with a thoroughly readable and entertaining magazine.

We write our magazine for people like you: people who simply enjoy playing games.

Keeping up with new games

We have our own panel of games experts who systematically test and report on new games. Over the last four years we've reviewed over 300 games, rating and reporting on them all for our readers.

Keeping up with new books

Every month we review new books on games, puzzles, crosswords and any other games subjects which we feel might be of interest to our readers.

Advice to games inventors

Our games testing panel is always ready and willing to offer advice to readers who are games inventors.

We can advise on the various technical aspects of games invention, the commercial prospects, who to contact, and even to test your game for you.

e world's most
w on games

Wargames

With the increasing interest in wargames and wargaming we have recently added a special section on wargames, incorporating reviews of published games, advice on tactics, articles on the history and origins of wargaming.

Classical games

Our chess section, 'Chess for Everyone' is written for the social chessplayer, not the expert.

You'll also find regular articles on the other classical games: backgammon, draughts, dominoes, etc.

Catering for the crossword enthusiast

We are generally acknowledged to have the world's leading crossword compilers among our contributors.

You'll find interesting articles written for both the expert and the beginner and, of course, a number of absorbing puzzles to solve in every issue.

Oriental games

Games originated in the Orient, so it's hardly surprising that some of the world's greatest games are to be found there — Go, Shogi, Mah-Jong.

We look at them all, explain the principles, investigate the tactics and tell you where to find them.

Puzzles and competitions

No magazine on the world of games could fail to explore the neighbouring world of puzzles and competitions.

We have pages of them, from the simple to the highly erudite.

Our monthly forum

Our readers' comments, criticisms, notes and queries are freely aired in our monthly forum.

Feature articles

Our editorial staff and guest contributors can always be relied on to provide articles of interest for you every month on every conceivable aspect of the world of games.

Our monthly report on the latest news

A general melange of news, reviews and interviews to keep our readers bang up-to-date on the games world.

Unusual games. Where to get them

If you've read about or seen a game (most likely in Games & Puzzles) and want to know where to find it we'll tell you where to look.

Or if it really is difficult to find we'll get it for you, and then mail it to you.

Free Games Voucher with every issue

Not only can we get you any game you're looking for, but we also offer you a 40p voucher with every issue of the magazine towards your next games purchase.

Special Introductory Offer

For new subscribers we offer a 3-months' trial period so you can vouch for yourself that our magazine really is all we claim. (And you'll still be eligible for the 40p games voucher offer).

If, during the initial 3-month period, you wish to cancel your subscription, we will immediately refund you your money in full.

Games and Puzzles Subscription Order

To: Circulation Manager
Games & Puzzles
11 Tottenham Court Road
London W1A 4XF
England

I enclose a cheque/money order/postal order for £ ....for 1/3 years commencing................................
19 ....

I understand that I may at any time during the initial 3-month period cancel my subscription and reclaim my money in full.

Name...

Address...

....

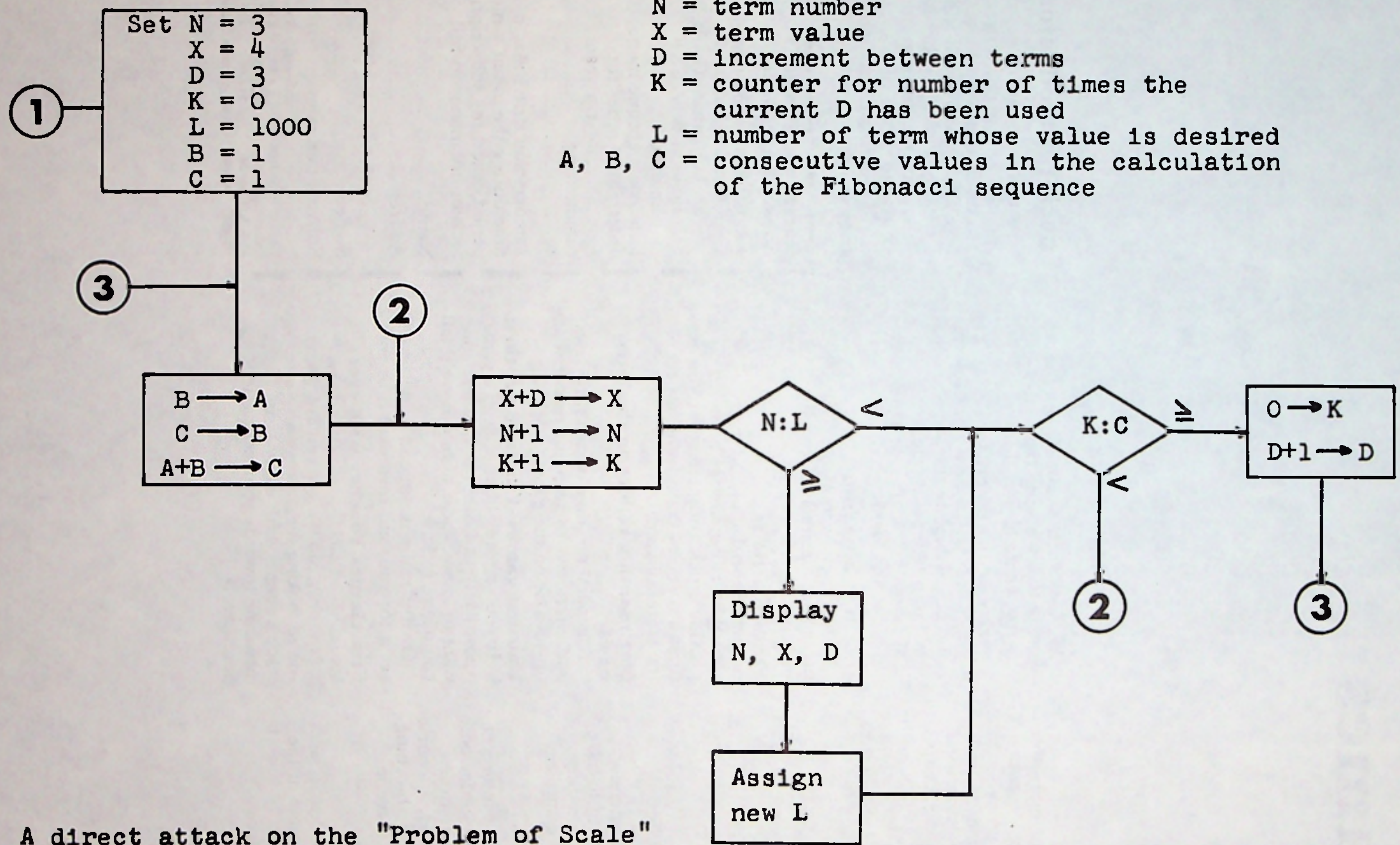
Signed.................................... .....

Subscription rates

	One year	Three years
United Kingdom	£4.80	£14.40
Other Countries	£5.40	£16.20
U.S.A./Canada	$12.00	$36.00

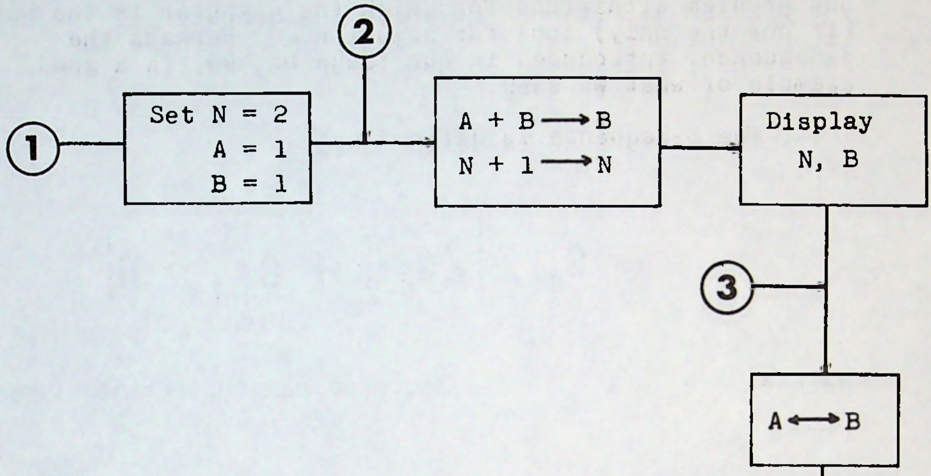
WIPAKGXY

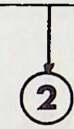
N = term number
X = term value
D = increment between terms
K = counter for number of times the current D has been used
L = number of term whose value is desired
A, B, C = consecutive values in the calculation of the Fibonacci sequence



A direct attack on the "Problem of Scale" sequence. At Reference 3, the next term of the Fibonacci sequence is calculated.

A simple scheme for generating the Fibonacci sequence is shown here.





The logic at Reference 3 calls for interchanging two numbers in storage. Many textbooks point out that this operation requires a temporary storage word, so that the interchange is effected with six instructions like these:

```
LDA    A
STØ    TEMP
LDA    B
STØ    A
LDA    TEMP
STØ    B
```

Professor John Motil, California State University, Northridge, shows that the extra word of storage is not necessary. The logic of an interchange can be:

$$B - A \longrightarrow B$$
$$A + B \longrightarrow A$$
$$A - B \longrightarrow B$$

and this can be done in seven instructions:

```
LDA    B
SUB    A
STØ    B
ADD    A
STØ    A
SUB    B
STØ    B
```

--a classic example of swapping data storage for instruction storage.

But going back to Problem 191, Mr. Ferguson has again demolished analytically a problem that was thought to be solvable only by computer. One of our goals is to seek out problem situations for which the computer is the best (if not the only) tool for solution. Perhaps the Z-Sequence, introduced in our issue No. 42, is a good example of what we seek.

The Z-Sequence is defined by:

$$a_n = |2a_{n-2} + a_{n-1} - n|$$

with $a_1 = a_2 = 1$. This sequence has interesting properties:

1. Successive terms seem unpredictable; that is, the values jump around, but not too wildly.

2. In the long run, its terms tend toward $n/3$, where n is the term number. Thus, the sum of the first 8002 terms is 11245744, whereas the sum of $n/3$ for $n = 1, 2, 3, \ldots, 8002$ is 11213501, a difference of only 32233.

3. The sequence is readily generated in any language on any machine, using the simplest of operations, and dealing only with positive integers. The accompanying table gives restart values at various points in the sequence.

4. No term after the first is ever as large as n. The circled numbers in the original table (see PC42-13) show the appearances of new larger values. Such new larger values are seen to occur 68 times in the first 5081 terms.

5. Zero appears at terms 3, 7, 11, 28, 31, 140, 239, 600, and 6476, but does not seem to appear after that. Up to $n = 5000$, only 67 terms have a value less than 5.

6. Successive equal terms appear at $n = 90$ and $n = 98$, but this phenomenon does not seem to occur again.

7. If item 2 above holds indefinitely, then the sum of the series should be approximately the sum of $n/3$. The sum of each term divided by n should be approximately $n/3$ itself. The sum of each term divided by the square of the term number should be approximately 1/3 the sum of the harmonic series (see PC9-14). The sum of each term divided by the cube of the term number, however, should approximate 1/3 the sum of $(1/n^2)$, which should converge. It appears to converge to 1.2346...

8. Almost every integer appears as a term in the sequence sooner or later, except for a few numbers, such as 245, 449, 569, 575, and 903.

A great deal of information has now accumulated about the Z-sequence. Table B shows the frequency, for every 1000 terms, of terms that are less than 1000. Although the trend is for terms to approximate $n/3$, where n is the term number, it is seen that small values persist with remarkable stability.

Zero terms occur well beyond the point (term 6476) first indicated. The following terms are zero:

3, 7, 11, 28, 31, 140, 239, 600, 6476,
33172, 64375, 65287, 79051, 97864, 105099.

and successive equal terms occur again at 5518 and 40722.

Table C shows the appearance of each integer from 000 to 499 for the first time in the sequence. Only 22 numbers are yet unaccounted for, from 000 to 999.

Table D shows restart values for the sequence, up to term 100,000. For each entry in the table, the last number is the term number (e.g., 10,000) and the other three are the term values at that term and the two that precede it. Thus, at 10,000, the table shows

term 9998: 4823
term 9999: 3634
term 10000: 3280

Table B

1000	1000	26000	73	51000	31	76000	25
2000	883	27000	81	52000	35	77000	27
3000	642	28000	50	53000	42	78000	22
4000	480	29000	33	54000	25	79000	18
5000	396	30000	60	55000	34	80000	17
6000	327	31000	61	56000	30	81000	18
7000	267	32000	57	57000	35	82000	29
8000	262	33000	63	58000	37	83000	22
9000	212	34000	56	59000	32	84000	24
10000	213	35000	49	60000	37	85000	26
11000	195	36000	62	61000	34	86000	24
12000	178	37000	46	62000	25	87000	30
13000	168	38000	53	63000	36	88000	20
14000	146	39000	73	64000	36	89000	16
15000	136	40000	53	65000	35	90000	15
16000	129	41000	41	66000	33	91000	23
17000	115	42000	47	67000	16	92000	21
18000	124	43000	41	68000	22	93000	21
19000	114	44000	45	69000	23	94000	17
20000	108	45000	35	70000	20	95000	30
21000	93	46000	40	71000	21	96000	21
22000	95	47000	38	72000	30	97000	16
23000	94	48000	36	73000	25	98000	14
24000	92	49000	40	74000	31	99000	15
25000	75	50000	39	75000	25	100000	24

Table D

167	799	1545	1953	2253	767	2517	7807
194	462	240	1404	340	4654	3260	22
472	60	330	1310	154	188	1294	7636
1000	2000	3000	4000	5000	6000	7000	8000
1291	4823	1655	5753	4447	8309	6187	3625
7422	3634	6818	2080	3546	4884	2778	9188
1004	3280	872	1586	560	7502	152	438
9000	10000	11000	12000	13000	14000	15000	16000
7847	2659	3833	12913	14039	6417	2669	15729
7050	6330	1024	5768	1806	11276	3968	3752
5744	6352	10310	11594	8884	2110	13694	11210
17000	18000	19000	20000	21000	22000	23000	24000
13021	16787	663	7277	9099	1991	3871	5747
7712	7294	17854	2348	6174	2686	16290	4698
8754	14868	7820	11098	4628	23332	6968	15808
25000	26000	27000	28000	29000	30000	31000	32000
15177	4655	23449	7149	3915	26897	6115	12507
7532	25758	3480	26576	32954	7328	7274	21946
4886	1068	15378	4874	3784	23122	19496	6960
33000	34000	35000	36000	37000	38000	39000	40000

Table D--Continued

11033	12245	16565	16315	2395	4471	4467	24751
26000	15080	18364	26798	5934	33806	23014	11270
7066	2430	8494	15428	34276	3252	15052	12772
41000	42000	43000	44000	45000	46000	47000	48000
6315	513	14769	341	31331	32831	23075	16751
25772	28596	3328	4264	8570	12954	21882	2638
10648	20378	18134	47054	18232	24616	13032	19860
49000	50000	51000	52000	53000	54000	55000	56000
4541	26239	9295	2077	20275	21557	36101	23439
12576	8814	5146	30104	34978	596	19060	21146
35342	3292	35264	25742	14528	18290	28262	4024
57000	58000	59000	60000	61000	62000	63000	64000
14115	18927	11663	30495	43671	36919	16137	47779
20890	35038	25794	30014	10822	23638	16648	9126
15880	6892	17880	23004	29164	27476	22078	32684
65000	66000	67000	68000	69000	70000	71000	72000
5805	31545	45139	36979	13545	4535	64929	2473
29432	2468	28170	2702	35732	46182	7888	43484
31958	8442	43448	660	14178	22748	58746	31570
73000	74000	75000	76000	77000	78000	79000	80000
27615	17787	16037	17871	35333	67975	37701	43
45682	16682	53140	198	10756	10922	21168	41726
19912	29744	2214	48060	3578	60872	9570	46188
81000	82000	83000	84000	85000	86000	87000	88000
4265	24787	51869	39035	10421	47615	59959	11837
57984	33974	8684	15606	2028	37306	17846	72904
22486	6452	21422	1676	70130	38536	42764	578
89000	90000	91000	92000	93000	94000	95000	96000
82425	21127	33709	12369	52201	172359	26473	170955
1136	36478	47796	27604	47992	14606	89536	86366
68986	19268	16214	47658	2394	159234	107518	128276
97000	98000	99000	100000	150000	200000	250000	300000

Table C

	0	1	2	3	4	5	6	7	8	9
00	3	6	4	5	35	10	8	26	15	38
01	20	13	55	77	27	70	56	53	36	282
02	44	73	75	69	64	34	32	585	51	30
03	139	165	72	121	535	97	83	253	67	469
04	168	61	147	146	59	93	123	286	815	1398
05	112	294	119	129	347	138	124	81	144	194
06	256	142	295	190	79	101	271	109	136	445
07	163	529	127	145	107	162	200	174	460	478
08	143	117	167	270	223	2979	203	678	316	157
09	408	293	115	274	188	218	228	730	551	134
10	423	186	1028	177	336	229	132	290	155	433
11	287	3188	1348	201	160	213	252	446	315	2252
12	320	1521	219	3609	307	193	667	153	2604	249
13	208	690	296	1078	359	257	356	577	236	321
14	592	489	184	314	980	313	268	393	247	2538
15	416	1074	407	182	291	226	216	537	732	426
16	484	266	455	962	1607	206	255	277	487	1537
17	319	341	3975	326	639	285	892	1573	399	1093
18	367	798	656	402	412	733	351	505	875	986
19	960	562	243	245	999	301	532	741	324	1441
20	392	834	7512	697	1135	942	364	477	243	3229
21	264	241	968	1285	283	410	1552	794	339	334
22	1223	654	467	637	380	262	1212	1597	1071	337
23	723	310	1215	734	672	4082	1340	533	1160	354
24	260	1893	619	538	4680		895	773	332	1566
25	695	346	1979	2193	1891	397	1128	362	1036	1030
26	2208	693	560	1022	419	2857	1155	518	5088	782
27	424	454	584	750	904	389	452	1221	432	482
28	2808	2590	515	1650	4252	885	1932	441	344	430
29	599	1018	1260	497	475	882	680	422	883	378
30	803	761	771	470	748	698	387	510	480	4101
31	439	742	536	1741	2279	549	1556	657	916	793
32	376	3997	1396	1433	1496	5450	996	4890	2239	1290
33	1812	1561	1159	1226	675	737	1600	554	596	530
34	707	581	952	374	2135	1166	792	578	372	525
35	1791	3218	751	858	1279	2178	1456	513	851	370
36	1908	649	508	450	1316	754	1251	1218	523	437
37	4135	2382	4444	1026	992	797	628	670	547	1458
38	731	1850	1419	1126	495	1921	1356	1137	907	846
39	3267	2277	1191	545	576	1393	543	1814	1332	1174
40	696	3510	2496	1382	3247	574	591	2501	1288	1849
41	1559	1261	1068	617	687	749	552	493	8747	865
42	647	721	804	694	612	1125	1528	1162	640	2085
43	747	1258	2264	922	816	2201	2180	1142	1852	826
44	1696	521	4643	953	2927	1581	1432	685	2299	
45	1184	785	1167	1053	1720	2406	2484	1354	1016	2674
46	1575	2821	1335	1670	1104	1678	2008	1861	716	541
47	5588	1005	1000	1517	823	1797	1015	3381	764	1278
48	3591		1324	1037	3139	3785	8891	589	668	969
49	1380	7410	2611	10082	2603	890	2867	2094	3347	610

That South American Roulette System

If you can obtain different odds on the same event, then you can guarantee a win for yourself by adjusting two bets. For example, suppose that you can obtain odds of 2:1 that A will win over B from one source, and odds of 3:1 from another source. You could bet as follows:

	if A wins	if B wins
Bet $6 that B wins at 2:1	-6	+12
Bet $6 that A wins at 3:1	+18	-6
net:	+12	+6

The situation was stated in extreme terms, but the principle is the same no matter how close the odds are, as long as they are different.

In general, given an event for which the odds on A winning are P and Q (and assuming that the P odds are better than the Q odds), then one could bet

$$PX - Y = \frac{Y}{Q} - X$$

where X and Y are the amounts to be bet. Then:

$$Y = \frac{1/P + 1}{1/Q + 1} X$$

giving the ratio of the bets. For example, if odds are given of 8:7 and 9:8 on A winning,

$$Y = \frac{8/7 + 1}{8/9 + 1} X$$

$$Y = (135/119) X$$

and one could bet 119 units on A with P odds, and 135 units on B with Q odds. Whether A or B wins, you collect one unit.

The so-called South American roulette system is based on these considerations. See the layout of the American roulette wheel. Odds of 1:1 are offered on either red or black. Odds of 2:1 are offered on each of the three columns of numbers. It is seen that we have:

column 1: 6 red, 6 black

column 2: 4 red, 8 black

column 3: 8 red, 4 black.

Consider column 1, with red and black evenly distributed. The chance of getting black in column 1 is thus 1:1, but the chance of landing in that column is 1 out of 3 (neglecting the chance of landing on zero or double zero). It appears then that we are presented with differing odds on the same event. This also appears to be true for the second and third columns. It would seem that some combination of betting simultaneously on red/black and on one of the columns would guarantee a win. (It won't, but you can have fun trying.)

When you have devised your winning system, you can play it by simulating a roulette wheel with a computer program and playing the system at high speed and low cost. A real-life wheel runs about 500 plays during an 8-hour shift and requires money to play. A computer-simulated wheel should run about 500 plays per minute, and you can set your own stakes and your own house limit.